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- [54] PREPARATIONS OF AZABICYCLOBUTANE  
PRECURSORS AND RELATED  
COMPOSITIONS
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- [58] Field of Search ..... 548/953, 961

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- 1802209 5/1970 Germany ..... 548/961

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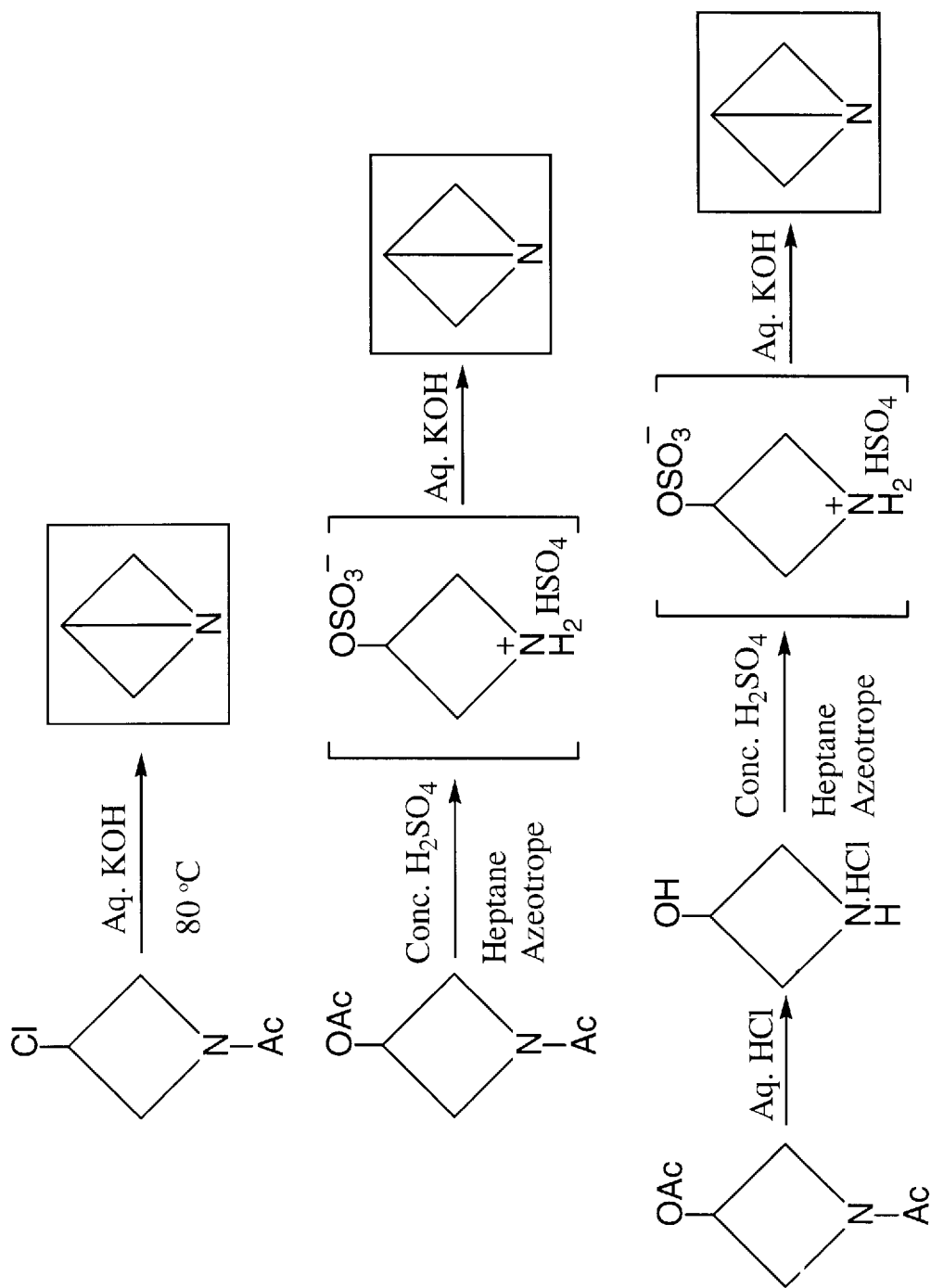
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[57] ABSTRACT

Azabicyclobutane can be produced by reacting azetidines under aqueous conditions to eliminate aza and 3-position substituents to effect cyclization. New azetidinyll compounds are described which can be intermediates in the preparation of the azabicyclobutane.

8 Claims, 1 Drawing Sheet



Figure

## PREPARATIONS OF AZABICYCLOBUTANE PRECURSORS AND RELATED COMPOSITIONS

### STATEMENT OF GOVERNMENT INTEREST

The invention described herein may be manufactured, used or licensed by or for the United States Government for governmental purposes without payment to the inventor(s) of any royalties.

### STATEMENT OF RELATED APPLICATIONS

This application is related to the U.S. patent applications described below; the applications have been filed on the same date as this application. The applications are:

DAR 4-94A	S.N. 08/440,947	May 15, 1995 allowed
DAR 4-94B	S.N. 08/440,946	May 15, 1995 allowed
DAR 4-94C	S.N. 68/440,945	May 15, 1995 abandoned
DAR 4-94D	S.N. 08/441,511	May 15, 1995 U.S. Pat. 5,580,988

### BACKGROUND OF INVENTION

Azetidines are four member ring compounds having one nitrogen and three carbon atoms. As a four member ring, there is ring strain which leads to difficulties in preparation of the azetidines and more difficulties in substitutions and modifications of azetidines. The compounds are of importance as intermediates leading to 1,3,3 trinitroazetidine, TNAZ, an energetic material that can be melt cast or press loaded into articles for use as an explosive or propellant. One route to TNAZ uses azabicyclobutane as an intermediate. This compound has bridgehead nitrogen and three carbon atoms in its ring. Azabicyclobutane is difficult to prepare and tends to decompose. The solid compound can be dangerous to handle.

### SUMMARY OF INVENTION

This application concerns new processes for the preparation of azabicyclobutane, new compounds that can be used as intermediates in the preparation of azabicyclobutane and compositions to prepare azabicyclobutane in situ.

### DETAILED DESCRIPTION OF DRAWINGS

FIG. 1 shows the preparation of azabicyclobutane and the new compounds and compositions of this invention which include certain substituted azetidines and the use of these azetidines to make TNAZ.

### DETAILED DESCRIPTION OF THE INVENTION

In general, the process of the invention proceeds by reacting an aza substituted, 3-substituted azetidine under conditions to cause elimination of the substituents at the aza and 3- positions. The aza substituent can be an acyl group or a sulfate ester. The reduction conditions are very clean in the sense that the product is an aqueous solution of the azabicyclobutane in innocuous salts. The solution can be used "as is" as the source of azabicyclobutane or the azabicyclobutane can be recovered from it. The yields of the process are very high.

Another alternative is to prepare solutions of the precursors and to conduct the elimination reactions at the point when the azabicyclobutane is needed. This is an in-situ preparation which can reduce the dangers of decomposition of the azabicyclobutane.

The FIGURE illustrates the several processes to prepare azabicyclobutane. In the first reaction scheme, N-acyl,3-

haloazetidine is reacted with aqueous alkali at moderate temperatures to cause elimination of the acyl group and the halide atom to effect the cyclization between the aza nitrogen and the 3- position carbon atom. The specific reactant, N-acetyl,3-chloroazetidine gives a very clean reaction product in the form of azabicyclobutane in water with non-deleterious salts.

Another alternate process shown in the FIGURE starts with an N-acyl,3-acyloxy azetidine. It is reacted with sulfuric acid to form an intermediate compound. The intermediate is an azetidine with a protonated aza hydrogen sulfate and a 3-sulfate ester. On treatment with aqueous alkali, the elimination occurs at the aza and 3- positions to give the azabicyclobutane product.

A third process starts with the N-acetyl,3-acetyloxyazetidine. It is hydrolyzed with hydrochloric acid to the quaternary aza hydrochloride salt of the azetidine with hydroxyl at the 3- position. This is converted to the sulfate ester as described above. The sulfate ester is reacted with aqueous alkali to form the azabicyclobutane.

These processes are under mild conditions and give high yields of product. As discussed, the reaction product is in an aqueous media and can be used as such or can be recovered from the reaction medium. The processes are easy enough to conduct that the reaction can be performed on site to provide in situ production of the azabicyclobutane as a reaction step in processes which use the azabicyclobutane. It can be seen that the acetyl group has the advantage that it readily leaves the azetidinyll skeleton in the cyclization mechanism. Sulfate acts in a similar manner.

As new compositions, this invention has the sulfate esters of the azetidines as new compounds. The compending related applications also cover new azetidine compounds and the processes of preparation. The N-acetyl,3-chloroazetidine is an example of such a compound.

It can be seen that the compounds and processes are capable of wide variation and modification. The new compounds and the efficiencies achieved with the invention are important contributions. However, while the preferred embodiments have been described with reference to particular features, sequences of steps, functional groups and other ring substituents and proportions, it is intended that this invention shall cover such structures, applications and uses as those in the field would deem equivalents.

We claim:

1. A process to prepare azabicyclobutane from an azetidine comprising reacting an aza substituted, 3-substituted azetidine in an aqueous alkali media to eliminate the aza and 3-position substituents and to effect cyclization between the aza nitrogen and 3- carbon positions to form the azabicyclobutane.

2. The process of claim 1 wherein the aza substituent is an acyl group and the 3-position carbon substituent is a halogen.

3. The process of claim 2 wherein the 3-position carbon substituent is chlorine.

4. The process of claim 1 wherein the 3- position carbon substituent is a sulfate ester.

5. The process of claim 1 wherein the azetidine is N-acetyl,3-chloroazetidine.

6. The process of claim 1 wherein the azetidine is 3-sulfato, aza-azetidinium sulfate.

7. The process of claim 1 wherein the aqueous alkali is aqueous potassium hydroxide.

8. The process of claim 1 wherein the process is carried out at a temperature of 80 degrees C.